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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 200554

In the Matter of Amendment of Parts 2 and 15 of the Commission's Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications	)	ET Docket No. 94-124
Petition of Sky Station International, Inc. for Amendment of the Commission's Rules to Establish Requirements for a Global Stratospheric Telecommunications Service in the 47.2-47.5 GHz and 47.9-48.2 GHz Frequency Bands	)	RM-8784

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REPLY COMMENTS OF SKY STATION INTERNATIONAL, INC.

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REPLY COMMENTS OF
SKY STATION INTERNATIONAL, INC.

Thirty-four comments were filed in response to Sky Station's Petition[1/] to establish revolutionary new global stratospheric telecommunications systems ("GSTS") in the 47 GHz band. Of these, only Motorola unequivocally opposes Sky Station's initiative to provide affordable worldwide Internet/World Wide Web and picturephone service. Hughes expresses concern that sharing studies be provided to support Sky Station's spectrum management position, and also understandably, USSB asks for assurance that there will be no shadowing of direct broadcast satellite television service. The remaining thirty-one commenters -- who represent a diverse cross-section of interests and 90% of the proceeding participants -- wholeheartedly

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1/ Request to Establish New GSTS Service, Additional Comments and Petition for Rulemaking ET Docket No. 94-124, RM-8784, filed by Sky Station International, Inc. ("Sky Station"), on March 20, 1996 (the "Petition"). The Petition appeared on public notice on April 1, 1996. See FCC Public Notice, Report No. 2127 (rel. Apr. 1, 1996).

support Sky Station's proposal, with the Telecommunications Industry Association ("TIA") requesting certain modifications.

Summary. Amidst this overwhelming support for GSTS, only three aspects of the Petition have been questioned: (1) the proper service definition, (2) the frequency sharing capabilities, and (3) the ability to protect public safety and respect national sovereignty. But as explained below, these questions have been answered with demonstrations that: (1) GSTS can fit within several existing service definitions, (2) co-channel frequency sharing among GSTS and conventional services[2/] would cause interference and thus not serve the public interest, and (3) there are no public safety or sovereignty issues that should delay the initiation of GSTS. For these reasons, Sky Station urges that the Commission dedicate spectrum in the Millimeter Wave Proceeding[3/] for GSTS, initiate a proceeding to adopt GSTS licensing rules, and process Sky Station's reference application as soon as possible.

I. SERVICE DEFINITION SHOULD REMAIN FLEXIBLE.

Although Sky Station created the name "Global Stratospheric Telecommunications Service", GSTS can be defined as "fixed", "fixed satellite", and perhaps "mobile" service. The term "GSTS" was developed for the sole purpose of differentiating those GSTS systems that operate in the "stratosphere" (whether as a GSTS fixed, GSTS mobile or GSTS FSS service)

[2/] As explained in Section I, GSTS falls within the definition of a fixed, mobile or fixed satellite service. For purposes of this filing, the prefix "conventional" is used to refer to a service application (in the fixed, mobile or fixed satellite service) that does not operate in the stratosphere (i.e., is not GSTS).

[3/] Amendment of Parts 2 and 15 of the Commission's Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications, Notice of Proposed Rulemaking, 9 FCC Rcd 7078 (1994); First Report and Order and Second Notice of Proposed Rulemaking, ET Docket No. 94-124, FCC 95-499 (rel. Dec. 15, 1995).

from "conventional" systems th it do not. It is thus important to clarify that the Petition does not (1) seek a new service definitio i or frequency allocation, or (2) request anything other than some minor adjustments to the dom stic and international table of allocations.

A. No New Servic Definitions Or Frequency Allocations Are Needed.

When new tele ommunications technologies are introduced, as with the GSTS, there is often some debate on how to classify them since they were not contemplated by the existing rules. However, R commendation Com 4A, adopted at WRC-95, establishes the principle of avoiding the creati on of new service definitions and being flexible in order to include new systems in the existing de initions. Consistent with this Recommendation Com 4A approach, the terms fixed, mobile and f xed satellite can be and should be interpreted broadly to include GSTS.[4]

1. GSTS is Fixed.

The ITU and he FCC define a fixed service as a "radiocommunication service between specified fixed poin s."[5] Since the geostationary platforms are fixed and many of the subscribers will be fixed, GS TS fits well within the definition of a fixed service.

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[4] These changes are ar appropriately flexible means of accommodating GSTS. While Sky Station appreciates the supp ortive thrust of TIA's comments, it does not believe it advisable to introduce the term "Global Airborne Telecommunications Service" because it would be a less flexible approach, entail co siderable delay and is not necessary, given the existing definitions. See Comments of TIA at 6 7.

[5] See 47 C.F.R. § 2.1 (1995).

2. GSTS Is Also FSS.

GSTS also can be defined as a fixed satellite service. The Commission and ITU have defined some satellite services, including mobile satellite and broadcast satellite services, as radiocommunications between earth stations and "space stations". Space stations, in turn, refer to "station[s] located on an object which is beyond, is intended to go beyond, or has been beyond, the major portion of the Earth's atmosphere."[6] The GSTS platforms, located in the stratosphere, unquestionably fall within the space station definition. Thus, the FCC and ITU regulations make clear that communications between GSTS platforms and earth stations -- which is precisely what is proposed in the Petition -- constitute "satellite" service under these provisions of the regulations.

The fixed satellite service refers to communications with "satellites". While the Commission has not confirmed that a stratospheric platform falls within the definition of "satellite," it can and should. To decide the contrary would create the anomalous result of allowing GSTS platforms to be used for mobile satellite and broadcast satellite services, but not for fixed satellite service. Moreover, it would run counter to the policy promoted in Com 4A regarding flexible definitions Therefore, GSTS is a fixed satellite service and is just as appropriate a use of the FSS allocation in the 47.2-50.2 GHz band as potential conventional FSS uses.

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[6] Id. (emphasis added). The mobile satellite service and the broadcast satellite service are defined in terms of "space stations" as opposed to satellites.

B. The GSTS Proposal Can Be Accommodated With Only Minor Footnote Changes To The Table Of Allocations.

Since GSTS fits under existing service categories, it does not require a new frequency allocation domestically or internationally. Instead, the proposal requires only some fine-tuning of footnotes of the existing 47.2-50.2 GHz frequency allocation to account for the practical impossibility (as explained in Section II) of stratospheric or GSTS systems and conventional systems (in the fixed, mobile and FSS services) sharing spectrum.

More specifically, Sky Station proposes to adjust the allocation footnotes to continue to allow fixed, mobile and fixed satellite services to operate in the 47.2-47.5 and 47.9-48.2 GHz bands, provided they use the stratospheric mode.[7] This accommodation serves the public interest because, as the thirty-one supporting comments show, stratospheric or GSTS systems have many benefits and no spectrum currently is dedicated for this purpose.

The revised footnotes would read as follows:[8]

Proposed MOD RR 901

> The allocation of the spectrum for the fixed-satellite service in the bands 42.5-43.5 GHz and 47.2-50.2 GHz for Earth-to-Space transmission is greater than that in the band 37.5-39.5 GHz for Space-to-Earth transmission in order to accommodate feeder links to broadcasting satellites. Administrations are urged to take all practical steps to reserve the band 47.5-47.9 GHz and 48.2-49.2

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[7] This is a minor adjustment to the footnote proposal in the Petition. Sky Station agrees with TIA's observation that new definitions are not advisable, and believes, based on the comments, that the objectives of its Petition can be effectively and properly accomplished by revising Footnote 901 and providing for a new footnote to limit "fixed, mobile and fixed satellite service use of the 47.2-47.5 and 47.9-48.2 GHz bands to stations in the stratosphere and their associated terrestrial and earth stations." See Comments of TIA at 7.

[8] These revisions reflect the ITU footnotes. Similar changes would be made to the domestic table of allocations.

GHz for feeder links for the broadcasting-satellite service operating in the band 40.5-42.5 GHz.

Proposed NEW RR XX

Use of the bands 47.2-47.5 GHz (Earth-to-Stratosphere) and 47.9-48.2 GHz (Stratosphere-to-Earth) by the fixed service, the mobile service, and the fixed-satellite service is limited to stations in the stratosphere and their associated terrestrial and earth stations.

II. FREQUENCY SHARING CAPABILITIES

Sky Station wants to assure the Commission and the commenters that its frequency proposal has been carefully designed to maximize the use of scarce spectrum, even though GSTS fixed/FSS cannot share co-channel frequencies with conventional fixed, mobile or fixed satellite services.

A. GSTS Cannot Share Co-Channel Frequencies With Other Services In The 47.2-50.2 GHz Band.

Sky Station recognizes the importance of trying to accommodate conventional fixed, mobile and FSS services in the 47.2-50.2 GHz band. However, Sky Station's reference application,[9] filed concurrently with the Petition, contains link budgets which demonstrate the technical impossibility of co-channel frequency sharing between GSTS and conventional services to which the 47.2-50.2 GHz band also is allocated.[10]

For example, a Sky Station antenna with 3 dBi gain cannot receive a Sky Station stratospheric signal when it is in the main path of a conventional fixed or conventional fixed

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[9] See Application of Sky Station International, Inc., File No. 96-SAT-P/LA-96, filed March 20, 1996 (the "Application") at 19-21.

[10] However, multiple GSTS systems can share co-channel frequencies. Sky Station, thus, does not seek spectrum for its own exclusive use.

satellite co-channel signal of greater power. This is a technical fact that cannot be changed, notwithstanding Sky Station' efforts to achieve co-channel frequency sharing.

Nevertheless, Motorola and Hughes[11] ask that the Commission require a compatibility analysis between GSTS and conventional services in the 47 GHz region. Appendix 1 offers straightforward technical analyses based on the information provided in Sky Station's Petition and reference application and demonstrates that co-channel frequency sharing with conventional services is not possible. Specifically, Appendix 1 confirms that:

- GSTS stratospheric stations would cause harmful interference to, and receive harmful interference from, conventional fixed service stations;
- GSTS land stations would cause harmful interference to, and receive harmful interference from, terrestrial fixed service stations;
- GSTS land stations could cause harmful interference to, and would receive harmful interference from, conventional FSS earth stations; and
- GSTS land stations would cause harmful interference to, and the stratospheric and land stations would receive harmful interference from, conventional FSS space stations.

Because of these sharing constraints, Sky Station intentionally selected for GSTS a 300+300 MHz portion of the underutilized 47.2-50.2 GHz band, leaving most of the band free for conventional services. In addition, conventional fixed and conventional FSS have other frequency bands in which they can operate. Given these considerations and the tremendous promise of GSTS, the public interest would be best served by dedicating the 47.2-47.5 and 47.9-48.2 GHz bands for GSTS fixed, mobile and fixed satellite use.

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[11] Opposition of Motorola at 2 and Opposition of Hughes at 4, filed on May 1, 1996 in ET Docket No. 94-124, RM-8784.

B. GSTS Will Not Obstruct DBS Line-Of-Sight.

Turning to USSB's concerns, Sky Station wants to confirm that GSTS will not shadow DBS-TV. Electromagnetic waves such as DBS-TV transmission will diffract around the 30 kilometer high platforms, ensuring continuous coverage on the ground. To provide even further assurances, Sky Station would be willing to accept a service rule requirement that GSTS not interfere with DBS-TV reception.

C. 300+300 MHz Is Needed To Accommodate Global Demand.

In response to TIA's questions,[12] it is important to clarify that 300+300 MHz of spectrum is needed for GSTS, in light of the potential ripple effects it could have on conventional fixed services. Although Sky Station can deploy its platforms economically and conduct its proposed operations with as little as 10+10 MHz of bandwidth, 300+300 MHz of bandwidth is needed to satisfy global demand. Indeed, market studies[13] project a need for more than 250 million broadband channels worldwide. With only 10+10 MHz, Sky Station can satisfy only a small fraction of this worldwide demand. But a full 300+300 MHz of bandwidth -- shared among multiple GSTS licensees authorized in the United States and abroad -- can provide 250 million simultaneous broadband channels.

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12 Comments of TIA at 7

13 See Attachment 1 to the Petition.

III. SOVEREIGNTY AND PUBLIC SAFETY ISSUES ARE READILY RESOLVABLE AND DO NOT JUSTIFY DELAY.

Finally, there are no national sovereignty or public safety justifications to delay the regulatory implementation of GSTS. The stratosphere is a region of proto-space that the United States and other countries have steadfastly refused to define as part of any nation's sovereign airspace.[14] This long-standing and firmly held United States position was adopted in order to promote advancement of technology that might otherwise be abandoned if there was an arbitrarily defined demarcation separating outer space from airspace.

The stratospheric geostationary platform technology underlying GSTS represents the very type of technological breakthrough that the United States wisely does not want to jeopardize with some arbitrarily delimited boundary. Indeed, representatives of three nations and numerous advocates for the developing world filed comments with the Commission eagerly anticipating the advent of GSTS. Australia's Ausproject International Pty. Ltd., noted that:

> GSTS technology could make a material difference in the delivery of health care and education, in improving the opportunities for employability and raising living standards, and in the quantity and quality of information available to citizens and decision makers alike.[15]

Mexico's state environmental organization, MESON, "wholeheartedly support[ed] all efforts to bring this to fruition," and urged the FCC to move promptly to approve GSTS to "bring about the principles of cooperation between our two countries a step further."[16]

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[14] See, e.g., United Nations General Assembly, Committee on the Peaceful Uses of Outer Space, Report of the Legal Subcommittee on the Work of Its 31st Sess. (1992), A/AC.105/514.

[15] Comments of Ausproject International Pty. Ltd. at 1.

[16] Comments of MESON at 1-2.

Britain's Overseas Development Administration, The World Bank, Mercy Medical Airlift, CARE, VITA and other development-oriented organizations all expressed strong support for the GSTS. With this indication of broad based international support, it is quite unlikely that countries will, as Motorola avers,[17] use theoretical arguments about the uppermost limit of sovereign airspace to cut themselves off from a crucial communications development technology. Indeed, many countries appear to be more concerned from the standpoint of national sovereignty about the unlimited bypass provided by LEO MSS systems such as Iridium than about the uppermost limit of airspace.

Motorola incorrectly contends that the Commission should stay or delay the creation and implementation of the revolutionary GSTS, pending definitive decisions regarding the aviation aspects of stratospheric stations.[18] Such a bureaucratic and costly approach is intended to thwart the introduction of a new service that will be competitive with satellite and other wireless services. There are no evident aviation-related obstacles to GSTS deployment, and Sky Station is vigorously coordinating with FAA officials who are studying whether and what FAA approvals are necessary. If FAA approvals are necessary, they will be in place prior to the time they are operationally needed.

Last, no public safety concerns have been raised that merit a delay in consideration and approval of GSTS. GSTS, in general, and Sky Station, in particular, are designed with multiple redundant safety features that will eliminate the risk of injury or harm to airborne vehicles and earth inhabitants. These safety features include multiply-redundant balloon modules

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[17] Opposition of Motorola at 5-6.

[18] Id. at 5.

(only half of which are sufficient to ensure a gentle and controlled landing), back-up parachute systems, multiple motion sensors (radar altimeters, accelerometers and GPS devices) and compatibility with helicopter recovery operations. Sky Station's composite and multiply-redundant approach to safety will result in a situation in which damage on earth is no more likely to occur than from satellite launch and de-orbit operations.

CONCLUSION

Sky Station commends the Commission for expeditiously placing the Petition and Application on public notice. As a result of the Commission's prompt action, a record has been created providing the Commission with more than enough support to move rapidly to establish GSTS as United States-licensed global systems and as a United States priority for WRC-97. Numerous commenters, representing interests as diverse as manufacturing and medical airlifts, have urged the Commission to move promptly in authorizing GSTS systems. While several thoughtful concerns were raised, Sky Station has resolved them with the appendix attached hereto and the arguments provided herein. Accordingly, Sky Station respectfully requests that the Commission move promptly in dedicating the 47.2-47.5 and 47.9-48.2 GHz bands to GSTS, initiating a proceeding to implement GSTS licensing rules, and granting Sky Station's reference application.

Respectfully Submitted,

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Appendix 1

Appendix 1

The purpose of this Appendix is to show that sharing in the 47 GHz band by GSTS FS/FSS and other services is not feasible in some circumstances, and presents formidable difficulties in others. On this basis it is concluded that GSTS FS/FSS should be the only type of fixed, mobile or FSS use of the identified frequency spectrum.

The Radio Regulations show the following Allocation to Services in the band 47.2 - 50.2 GHz:

FIXED
FIXED-SATELLITE (Earth-to-space) 901
MOBILE 905
904

There are no known operational services in this band. Note 901 urges "steps to reserve the band 47.2 - 49.2 GHz for feeder links for the broadcasting-satellite service operating in the band 40.5 - 42.5 GHz". Notes 904 and 905 do not apply to the bands of interest for GSTS FS/FSS, and mobile services are not in these specific bands.

There are few Reports and no Recommendations dealing with the shared use of the 47 GHz band; only CCIR Report 209-5 and Report 876 are found to be relevant.[1] However, the possibility of sharing at 40 GHz between Fixed and Fixed-Satellite stations was studied by the CCIR and the following tentative conclusion was reached:[2]

"... the minimum separation distance is about 52 km within ±1° of the terrestrial antenna main-beam axis and about 1 km for off-axis angles greater ±40° for an earth station antenna elevation angle greater than 30°, ..."

It should be noted that this conclusion is based on the relatively fixed relationship between elements of the FS and FSS services. As examples, the FS stations are not expected to point towards the geostationary arc, and the FSS earth stations could be expected to have high elevation angles. In contrast, such benign conditions are not expected in the GSTS FS/FSS. There will be many (several hundred) around the world, at any latitude; of course the Sky Stations will be much closer to the Earth than space stations. The geometry is illustrated in Figure 1.

The GSTS FS/FSS bands being proposed are 47.2 - 47.5 GHz uplink and 47.9 - 48.2 GHz downlink; these bands are sufficiently close to the 40 GHz covered in Rep. 876, so that the Fixed Service and Fixed Satellite Service parameters assumed there are considered suitable in the

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1 **REPORTS OF THE CCIR, 1990**, ANNEX TO VOLUMES IV AND IX - PART 2
REPORT 209-5, FREQUENCY SHARING BETWEEN SYSTEMS IN THE FIXED-SATELLITE SERVICE AND TERRESTRIAL RADIO SERVICES, (1986).
REPORT 876, FREQUENCY SHARING BETWEEN SYSTEMS IN THE FIXED-SATELLITE SERVICE AND THE FIXED SERVICE IN FREQUENCY BANDS ABOVE 40 GHz, (1982).

2 Page 9, Rep. 876.

analyses which follow.

The parameters of the fixed and fixed-satellite stations as postulated for 40 GHz in Tables I and II of Rep. 876, and the corresponding parameters of the GSTS FS/FSS are given in Table 1.

The following analyses first cover some cases related to the Fixed Service, then several cases involving the Fixed Satellite Service are presented. To illustrate these cases, Figure 1 contains a diagram of the geometry and interference scenarios. Table 2 is a compilation of the interference scenarios and the resultant C/I.

Interference between the GSTS FS/FSS and Other Fixed Service Stations

1. The most likely source of uplink interference into the Sky Station receiver from FS stations, if they were to operate co-frequency with GSTS FS/FSS in the 47.2 - 47.5 GHz band, is where a FS transmitter is located at the edge of the Footprint Area Coverage (FAC) region. At the edge of the FAC the Sky Station is at 0° elevation, and the FS station main beam would be pointing directly at the Sky Station. From Table 1, the FS main-beam e.i.r.p. would be 33.5 dBW / 200 MHZ, which is -1.1 dBW / 70 kHz. Simultaneously, the Sky Station would be receiving wanted signals from the FAC, WAC and HAC regions. On the basis that the Sky Station receive antenna gain in combination with the variations in path loss will match the indicated e.i.r.p. variations for each region, the expected receive Carrier to Interference ratios (C/I) are calculated and shown in Table 2, scenarios 1a, 1b, and 1c respectively.

2. In the reverse direction, i.e. the downlink band of 47.9 - 48.2 GHz, the worst potential source of interference from the Sky Station to a FS receiver is where the FS station is located at the edge of the FAC region, since the FS station is pointing directly at the Sky Station. From Table 1 we note that the power density received at the stations located at the FAC edge is -155.5 dBW / 70 kHz. Assuming the typical power received at this FS station from an associated FS station at 4 km distance (with 136.5 dB loss) is about -137.1 dBW / 70 kHz, Table 2, scenario 2 shows the resultant C/I at this FS station. This C/I of 17.7 dB is not acceptable.

3. A (land) Base Station in GSTS FS/FSS would normally be distinguishable from Fixed Service stations only by its higher elevation angle. However, in some circumstances it may be located in the WAC region at a low elevation angle.

   (a) Through its sidelobes, the Base Station would receive interference from the FS station in the downlink band 47.9 - 48.2 GHz. From Table 1, using the FS peak transmit power of 33.5 dBW, the received carrier power of -172.9 dBW / 70 kHz, and assuming 4 km of separation, the computed C/I is shown in Table 2, scenario 3a.

Table 1: Parameters for Fixed, Fixed-Satellite ES and GSTS FS/FSS

Service / **Parameter**	units	RRS in FS	ES in FSS	GSTS FS/FSS SC in FAC	GSTS FS/FSS SC in WAC	GSTS FS/FSS SC in HAC	GSTS FS/FSS BS in HAC
Bandwidth	MHZ	200	100	0.070	0.070	0.070	1.4
Noise Temperature	K	630 [a]	30 [b]	500	500	500	300
Antenna diameter	m	0.6	3	-	-	-	1
Antenna Gain	dBi	46	60	36	23	3	50
e.i.r.p. of earth stations	dBW	33.5	70	25.5 + 6.0	12.5	-7.5	32.5
Span / Range	km	4	38,000	600	164	58	35
Fading margin	dB	42	31.2 ($\theta = 45°$)	28 (objective)	21 (objective)	10 (objective)	>40 (objective)
e.i.r.p. of Sky Station per user	dBW	-	-	27.7	21.7	21.7	-1.3
Received carrier power / 70 kHz [c] at the GSTS FS/FSS receivers	dBW	-	-	-155.3	-149.3	-140.3	-172.9

BS Base Station (in GSTS FS/FSS)
ES Earth Station (uplink, feeder)
FS Fixed Service (terrestrial)
FSS Fixed Satellite Service (Earth to space)
GSTS Global Stratospheric Telecommunications System
RRS Radio-Relay System
SC Stratus Communicator™ (in GSTS FS/FSS)
SS Sky Station (in GSTS FS/FSS)

[a] The assumed Noise Figure is 5 dB.
[b] This noise temperature appears to be unusually low; at best it is 300 K.
[c] These EIRP are estimated in the link budgets.

Note: GSTS FS/FSS technical parameters shown in Tables 1 and 2 are consistent with the link budgets presented in the Application.

Table 2: Interference Scenarios and Calculated C/I

GSTS FS/FSS and Conventional FIXED SERVICE

Scenario number			(FAC) 1a	(WAC) 1b	(HAC) 1c	2	3a	3b	4
FS EIRP / 200 MHz	a	dBW	33.5	33.5	33.5	33.5	33.5	33.5	33.5
Conversion ratio (200 MHz to 70 kHz)	b	dB	34.6	34.6	34.6	34.6	34.6	34.6	34.6
FS EIRP towards Sky Station / 70 kHz	c	dBW	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1
FS Path loss at 4 km, 40 GHz	d	dB				136.5	136.5	136.5	136.5
FS received power / 70 kHz	e	dBW			(c - d)>>	-137.6	-147.6	-137.6	-137.6
GSTS BS EIRP / 1.4 MHz	f	dBW						32.5	
GSTS BS EIRP / 70 kHz	g	dBW	31.5	12.5	-7.5			19.5	
Received power / 70 kHz from Sky Stn	h	dBW				-155.3	-172.9		-140.3
GSTS receive gain	i	dB					50.0	50.2	3.0
			(g - c)	(g - c)	(g - c)	(e - h)	(h + i - e)	(e-g+i+10+d)	(h + i - e)
C/I of Received GSTS FS/FSS signals		dB	32.6						
C/I of Received FS signals		dB						39.7	

GSTS FS/FSS and Conventional FIXED SATELLITE SERVICE

Scenario number			(FAC) 5a	(WAC) 5b	(HAC) 5c	(Base) 5d	(FAC) 6a	(WAC) 6b	(HAC) 6c
FSS EIRP / 100 MHz	j	dBW	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Conversion ratio (100 MHz to 70 kHz)	k	dB	31.5	31.5	31.5	31.5	31.5	31.5	31.5
FSS EIRP / 70 kHz	l	dBW	38.5	38.5	38.5	38.5	38.5	38.5	38.5
FSS main beam gain	m	dBi					60.0	60.0	60.0
FSS sidelobe gain	n	dBi					-10.0	-10.0	-10.0
Path loss at 4 km, 40 GHz	o	dB					136.5	136.5	136.5
Sidelobe received power / 70 kHz	p	dBW					-168.1	-168.1	-168.1
GSTS EIRP / 70 kHz	q	dBW	31.5	12.5	-7.5	19.5			
Received carrier power / 70 kHz	r	dBW					-155.3	-149.3	-140.3
			(q - l)	(q - l)	(q - l)	(q - l)	(r - p)	(r - p)	(r - p)
C/I of GSTS FS/FSS		dB							27.8

(b) The FS station will receive interference from the Base Station sidelobe in the band 47.2 - 47.5 GHz For the peak transmit power of 32.5 dBW (Table 1), the C/I of the FS carrier is shown in Table 2, scenario 3b.

It should be noted that this interference is based on the GSTS antenna elevation being above 42° (for $\theta > 48,^{\circ}$ the gain is -10 dBi). Up to this elevation angle, the sidelobe gain is assumed to be -10 dBi, below this elevation angle the interference gain increases by 29 - 25 log θ.

4. The GSTS FS/FSS with 3 dBi gain in the receive band of 47.9 - 48.2 GHz would be rendered useless when operating within the terrestrial beams. As an example, within the HAC region, at a distance of 4 km from a FS transmitter, and within its main beam, with a received carrier power density of -140.3 dBW/kHz (from Table 1), the resultant C/I is calculated in Table 2, scenario 4. The receive C/I in the WAC and FAC would be considerably worse. These interference scenarios are clearly not acceptable.

In the reverse direction, in the band 47.9 - 48.2 GHz, the GSTS transmitter with an e.i.r.p. of -7.5 dBW / 70 kHz would cause significant interference when in the receive main beam of an FS station which typically receives a level of -137.6 dBW / 70 kHz. So a separation of more than 50 km, as in Rep. 876, would seem to be necessary, and this is also unacceptable.

It is concluded that sharing the bands 47.2 - 47.5 and 47.9 - 48.2 GHz between GSTS FS/FSS and FS would not be possible, particularly in view of the results from cases 2 and 4.

Interference between the GSTS FS/FSS and the Conventional Fixed Satellite Service

5. A FSS station uplink transmission in the band 47.2 - 50.2 GHz interferes with the GSTS FS/FSS receivers in the Sky Station in the band 47.2 - 47.5 GHz. These feeder stations would be operating at high power most of the time. The flux densities, certainly from the main beam of the earth station and likely from sidelobes, would be very high at the altitude of 30 km. The Sky Station receiver is designed to receive from very small, low-gain, low-power transmitters, so the interference from the FSS would clearly be harmful.

From Table 1, the FSS main beam e.i.r.p. is 70 dBW / 100 MHZ = 38.4 dBW / 70 kHz. Depending on the location of the GSTS transmitters, their relative e.i.r.p. in the direction of the Sky Station, their resultant receive C/I ratios for the FAC, WAC and HAC regions are shown in Table 2, scenarios 5a, 5b, 5c and 5d respectively. These interference scenarios are clearly no acceptable.

There is some potential for interference into the FSS satellite receiver from GSTS uplink transmissions in the 47.2 - 47.5 GHz band. For example, the peak transmit power density for a GSTS unit located in the FAC area is 31.5 dBW / 70 kHz; this is 6.9 dB below the

power density of the FSS uplink transmission of 38.5 dBW / 70 kHz. This is the worst case and it might be unacceptable depending on the modulation or signal content; it is unlikely that many of these transmissions would be pointed at any particular satellite.

6. A conventional FSS earth station uplink transmission can also interfere with all GSTS receivers operating in the band 47.9 - 48.2 GHZ, through its off-beam emissions. Assuming the FSS station is transmitting at a high elevation angle, at its expected e.i.r.p. of 70 dBW, the interference would be emitted from the antenna sidelobe at a gain of -10 dBi. At a distance of 4 km for example, and using the received carrier power from Table 1, the C/I ratios for signals received by GSTS receivers located in the FAC, WAC and HAC regions are shown in Table 2, scenarios 6a, 6b and 6c respectively.

   GSTS FS/FSS transmit stations will not interfere with FSS earth stations, which do not receive in this band.

It is concluded that sharing the band 47.2 - 47.5 GHz between GSTS FS/FSS and FSS would be not be possible, where the main problem is described in case 5.

Incremental Degradation due to Interference

The GSTS FS/FSS as planned by Sky Station International is expected to have an Availability of 98% globally, which is deemed to be acceptable by the users. For example, a total margin of 10 dB has been allocated for the HAC region; most of this margin is for propagation effects. Any further degradation of the service, such as that caused by aggregated interference from FS and FSS signals, would render the service less acceptable.

To avoid such incremental degradations, the bands 47.2 - 47.5 and 47.9 - 48.2 GHz should be restricted to the GSTS FS/FSS

Conclusion

Although there could be isolated cases of sharing arrangements as postulated in the CCIR Report, it has been demonstrated that there would be harmful interference scenarios in particular to the hand-held unit operating in the High Area Coverage, which is the most populated and best served by GSTS FS/FSS.

Table 3 provides a summary of harmful interference scenarios which have been identified between the GSTS FS/FSS and the conventional FS and FSS services. Consequently, it is concluded that GSTS FS/FSS should be the only type of fixed, mobile or FSS use of the identified frequency spectrum.

Table 3: Summary of Harmful Interference Scenarios

	CAUSES INTERFERENCE TO	RECEIVES INTERFERENCE FROM
GSTS Sky Station (Rx 47.2 - 47.5 GHz) (Tx 47.9 - 48.2 GHz)	FS Stations in FAC region (downlink Tx) (47.9 - 48.2 GHz)	FS Stations in FAC area (uplink Rx, 47.2 - 47.5 GHz) FSS pointed in its direction (uplink Rx, 47.2 - 47.5 GHz)
FS Station (Tx and Rx (47.2 - 50.2 GHz)	GSTS Stations in WAC & HAC (Rx 47.9 - 48.2 GHz)	GSTS Stations in HAC region (Tx 47.2 - 47.5 GHz)
GSTS Stations (Tx 47.2 - 47.5 GHz) (Rx 47.9 - 48.2 GHz)	FS Stations (Rx 47.2 - 47.5 GHz)	FS Stations (Tx 47.9 - 48.2 GHz) FSS Space Stations (Rx 47.2 - 47.5 GHz)
FSS Stations (Tx 47.2 - 50.2 GHz)	GSTS Sky Station (Rx 47.2 - 47.5 GHz) GSTS Land Stations in FAC, WAC and HAC regions (Rx 47.9 - 48.2 GHz)	Not Applicable (Rx band not within GSTS as proposed)

FAC Footprint Area Coverage
FS Fixed Service
FSS Fixed Satellite Service
GSTS Global Stratospheric Telecommunications System
HAC High Area Coverage
WAC Wide Area Coverage

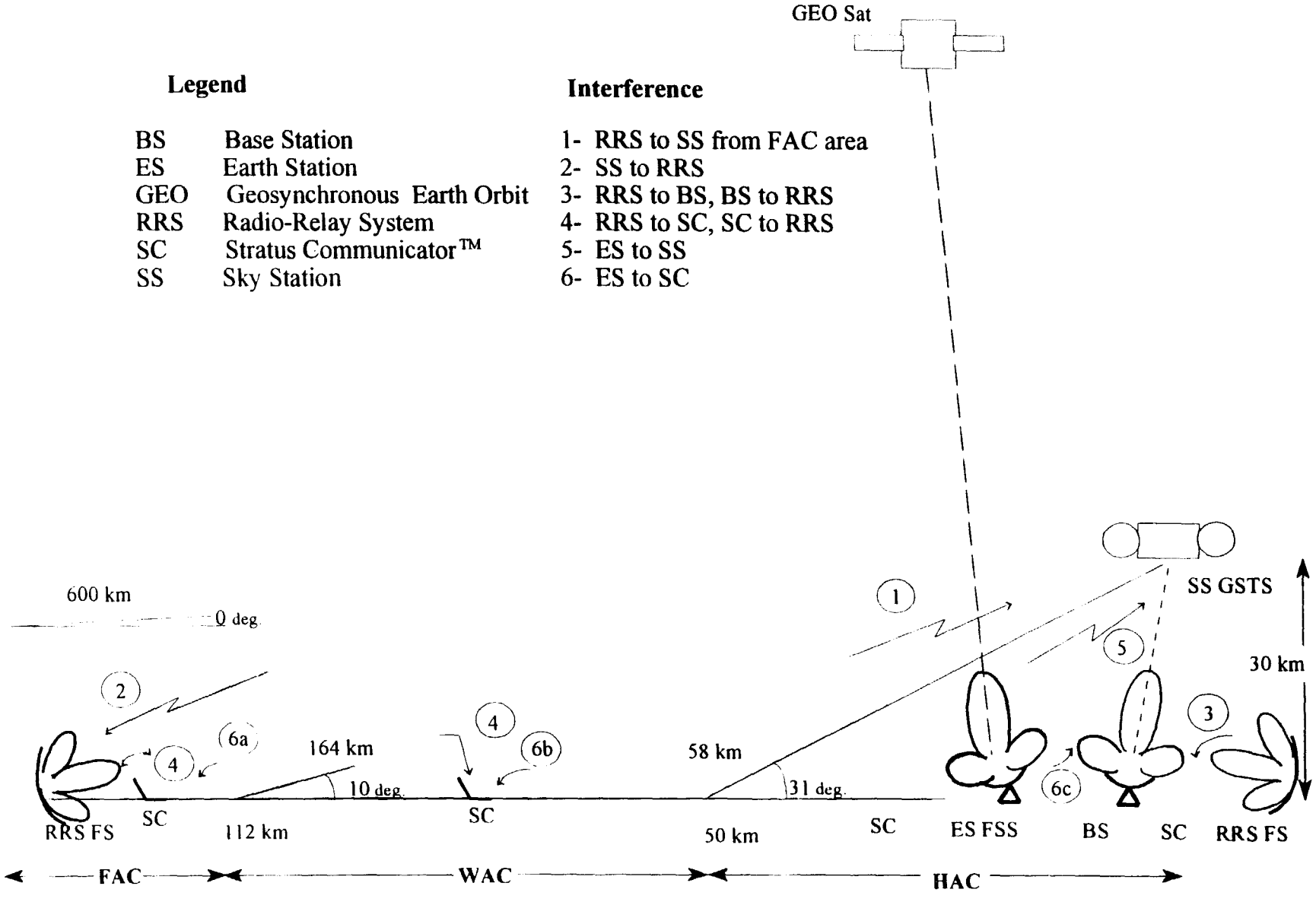

Figure 1 Geometry and Interference Scenarios for GSTS FS/FSS, FS and FSS

Certificate of Technically Qualified Person

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in this ~~Application~~ Appendix, that I am familiar with Part 25 of the Commission's Rules, that I have either prepared or reviewed the engineering information submitted in this ~~Application~~ Appendix, and that it is complete and accurate to the best of my knowledge. jaj jaj

Jack L. Dicks
Vice President
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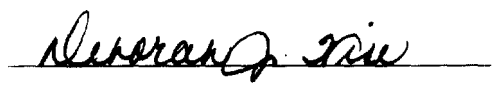
Dated: 5/16/96

CERTIFICATE OF SERVICE

I, Deborah J. Wise, a secretary with the law firm of Covington & Burling, do hereby certify that copies of the foregoing Reply Comments of Sky Station International, Inc. were sent via first class mail, postage prepaid, to the parties on the attached list.



Deborah J. Wise